RF Test Report

Applicant	:	Redpine Signals Inc
Product Type	:	Single Band 802.11 b/g/n, Bluetooth 5.0, ZigBee Module
Trade Name	:	Redpine Signals Inc
Model Number	:	M15SB
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Receive Date	:	Oct. 24, 2018
Test Period	:	Nov. 06 ~ Dec. 05, 2018
Issue Date	:	Dec. 17, 2018

Issue by

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade District,
Taoyuan City 33465, Taiwan (R.O.C)
Tel：+886-3-2710188 / Fax：+886-3-2710190

Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Dec. 06, 2018	Initial Issue	Janet Chao
01	Dec. 17, 2018	Revised Report Information	Janet Chao

Verification of Compliance

Issued Date: Dec. 17, 2018

Applicant	:	Redpine Signals Inc
Product Type	:	Single Band 802.11 b/g/n, Bluetooth 5.0, ZigBee Module
Trade Name	:	Redpine Signals Inc
Model Number	:	M15SB
FCC ID	:	XF6-M15SB
EUT Rated Voltage	:	DC 1.8 V 0.4 A/ DC 3.3 V 0.4 A
Test Voltage	:	DC 3.3 V
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade District, Taoyuan City 33465, Taiwan (R.O.C) Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330 http://www.atl-lab.com.tw/e-index.htm

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By	: Fly Lu	Reviewed By	: Eric Ou Yang	
(Manager)	(Fly Lu)	(Testing Engineer)	(Eric Ou Yang)	

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1 General Information

1.1 Summary of Test Result

Standard	Item	Result	Remark
FCC			
15.207	AC Power Conducted Emission	N/A	The device uses DC power source.
15.247(d)	Transmitter Radiated Emissions	PASS	-----
15.247(b)(3)	Max. Output Power	PASS	-----
15.247(a)(2)	6 dB RF Bandwidth	PASS	-----
15.247(e)	Maximum Power Spectral Density	PASS	-----
15.247(c)	Out of Band Conducted Spurious Emission	PASS	-----
15.203	Antenna Requirement	PASS	-----

The test results of this report relate only to the tested sample(s) identified in this report.

Standard	Description
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074 D01 v05	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

1.2 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9 kHz ~ 150 kHz	2.7
	150 kHz ~ 30 MHz	2.7
Radiated Emission	9 kHz ~ 30 MHz	1.7
	30 MHz ~ 1000 MHz	5.7
	1000 MHz ~ 18000 MHz	5.5
	18000 MHz ~ 26500 MHz	4.8
	26500 MHz ~ 40000 MHz	4.8
Conducted Output Power	+0.27 dB / -0.28 dB	
RF Bandwidth	4.96 %	
Power Spectral Density	+0.71 dB / -0.77 dB	

2 EUT Description

Applicant	Redpine Signals, Inc 2107 N.First Street, Suite 680, San Jose, California, 95131-2019, United States			
Manufacturer	Redpine Signals, Inc 2107 N.First Street, Suite 680, San Jose, California, 95131-2019, United States			
Product Type	Single Band 802.11 b/g/n, Bluetooth 5.0, ZigBee Module			
Trade Name	Redpine Signals Inc			
Model Number	M15SB			
FCC ID	XF6-M15SB			
Frequency Range	Zigbee: 2405 MHz ~ 2480 MHz			
Modulation Type	O-QPSK			
Channel Number	16CH			
Antenna Information	Model	Type	Connector	Max. Gain (dBi)
	RSIA15	PCB Trace Antenna	Internal	0.99
	WS.01.B.305151	Heavy Duty Screw Mount Antenna	SMA Reverse	4.10
Operate Temp. Range	-40 ~ +85 ℃			

Frequency Band	Max. RF Output Power (W)
Power setting 1_Antenna Type: PCB Trace Antenna	
Zigbee, O-QPSK	0.10257
Power setting 2_Antenna Type: Heavy Duty Screw Mount Antenna	
Zigbee, O-QPSK	0.06887

3 Test Methodology

3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit mode
Mode 2: Continuous TX mode

Note:
1. EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98 %
2. Software used to control the EUT for staying in continuous transmitting mode was programmed. After verification, all tests were carried out with the worst case test modes.
3. preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “X axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

ZigBee link mode:

Channel Low (2405 MHz), Channel Mid (2440 MHz) and Channel High (2480 MHz) were chosen for full testing.

RF Power setting	Antenna Type	Antenna Max. Gain (dBi)	Test Mode	Antenna Delivery	Frequency (MHz)
1	PCB Trace Antenna	0.99	Mode 2	1TX	2405, 2440, 2480
2	Heavy Duty Screw Mount Antenna	4.1	Mode 2	1TX	2405, 2440, 2480
Note:Redpine software has antenna selection parameter which enables the user to select the antenna and it internally adjusts the gain parameters.Default antenna type will be Redpine PCB antenna.					

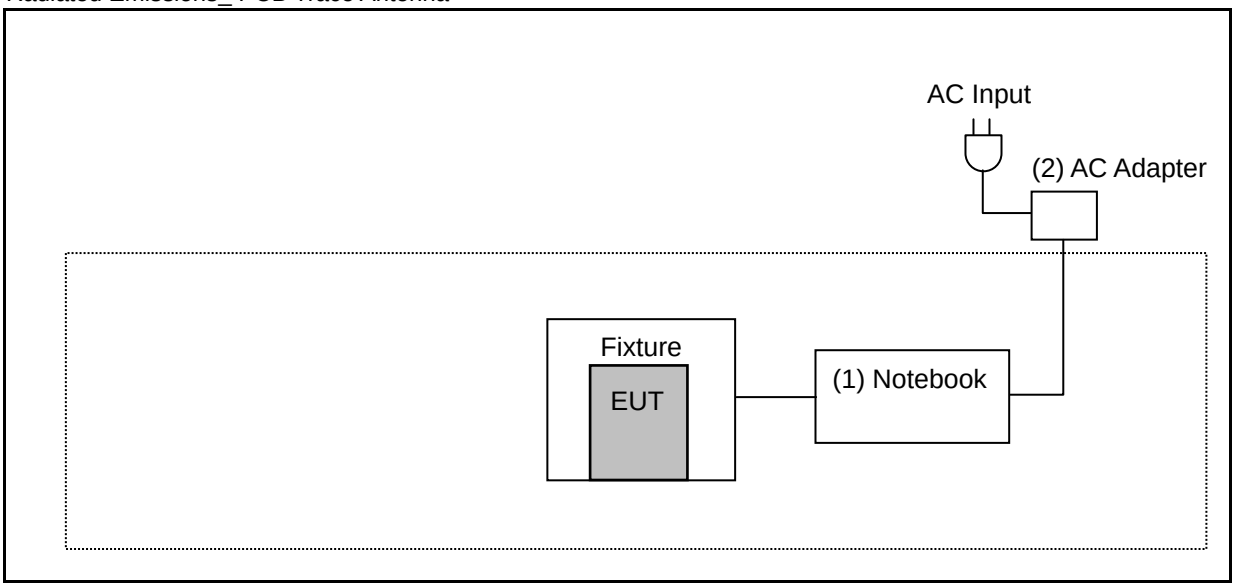
3.2. EUT Test Step

1	Setup the EUT shown on “Configuration of Test System Details.”
2	Turn on the power of all equipment.
3	Turn on TX function
4	EUT run test program.

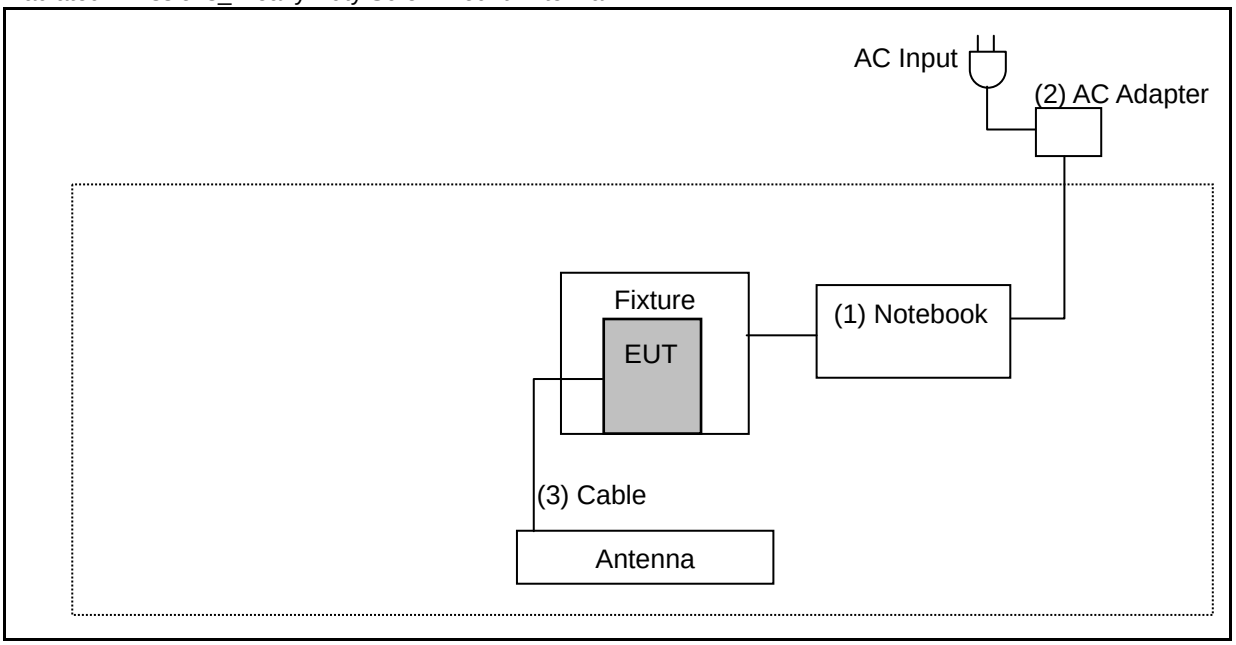
Measurement Software			
No.	Description	Software	Version
2	Radiated Emission	EZ EMC	1.1.4.4

3.3. Configuration of Test System Details

Radiated Emissions_ PCB Trace Antenna



Radiated Emissions_ Heavy Duty Screw Mount Antenna



Devices Description						
Product		Manufacturer	Model Number	Serial Number	Power Cord	Loss
(1)	Notebook	DELL	Inspiron 15	726RWN2	---	---
(2)	AC Adapter	DELL	LA65NS2-01	---	Non-Shielded, 0.8 m	---
(3)	Cable	Amphenol RF	336314-12-0100	---	---	0.38 dB

3.4. Test Instruments

For Radiated Emissions

Test Period: Nov. 06 ~ Dec. 05, 2018

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer (10 Hz~44 GHz)	Keysight	N9010A	MY52221312	01/15/2018	1 year
Pre Amplifier (1~26.5 GHz)	Agilent	8449B	3008A02237	10/19/2018	1 year
Pre Amplifier (100 kHz~1.3 GHz)	Agilent	8447D	2944A11119	01/10/2018	1 year
Trilog Broadband Antenna	SCHWARZBECK MESS-ELEKTRONIK	SB AC VULB	9168-0841	03/02/2018	1 year
Horn Antenna (1~18 GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	08/23/2018	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	03/13/2018	1 year
RF Cable	EMCI	EMC104-N-N-6000	TE01-1	02/20/2018	1 year
Microwave Cable	EMCI	EMC102-KM-KM-14000	151001	02/20/2018	1 year
Broadband Horn Antenna	SCHWARZBECK MESS-ELEKTRONIK	9170	9170-320	08/07/2018	1 year

For Conducted

Test Period: Dec. 05, 2018

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Power Sensor	Anritsu	MA2411B	1126022	08/29/2018	1 year
Power Meter	Anritsu	ML2495A	1135009	08/29/2018	1 year
Spectrum Analyzer (3 Hz~50 GHz)	Agilent	N9030A	MY53120541	01/02/2018	1 year
Microwave Cable	EMCI	EMC102-SM-SM1500	001	11/21/2018	1 year

Note: N.C.R. = No Calibration Request.

3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	990

4 Measurement Procedure

4.1. Radiated Emission Measurement

■ **Limit**

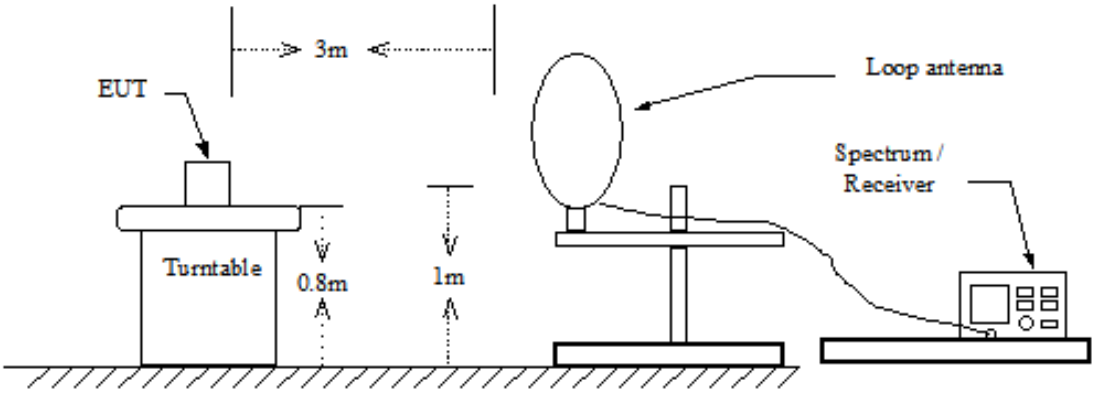
According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m at meter)	Measurement Distance (meters)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 - 88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

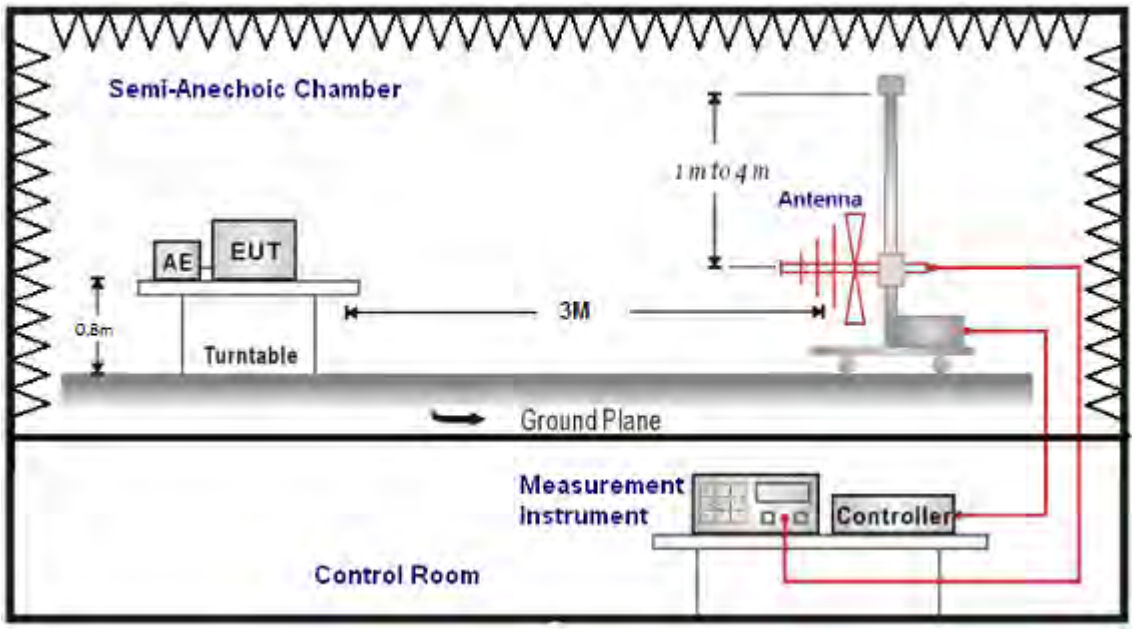
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

■ **Setup**

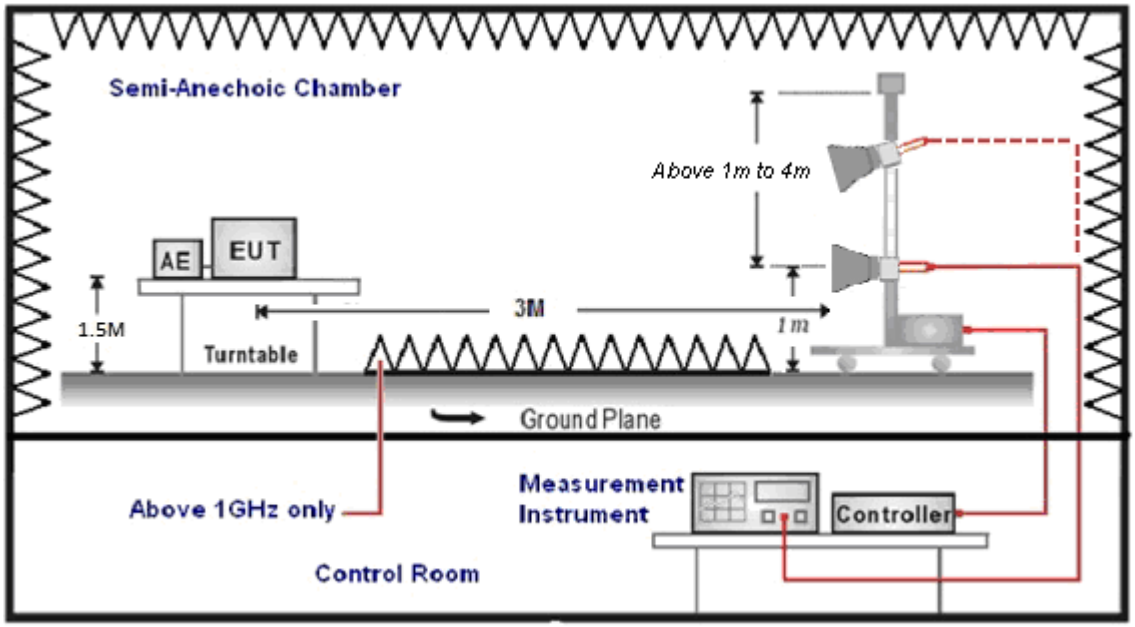
9 kHz ~ 30 MHz



Below 1 GHz



Above 1 GHz


Semi-Anechoic Chamber
Above 1m to 4m
AE
EUT
1.5M
3M
1 m
Turntable
Ground Plane
Above 1GHz only
Measurement
Instrument
Controller
Control Room

■ **Test Procedure**

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 26.5 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements when Duty cycle >0.98 / 1/T for average measurements when Duty cycle <0.98. A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna was used in frequencies 1 –26.5 GHz at a distance of 3 meter. The antenna at an angle toward the source of the emission. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts pre meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro colts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

(1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)
FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.
P.S Amplitude is auto calculate in spectrum analyzer.

(2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)
The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:
(a) For fundamental frequency : Transmitter Output < +30 dBm
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

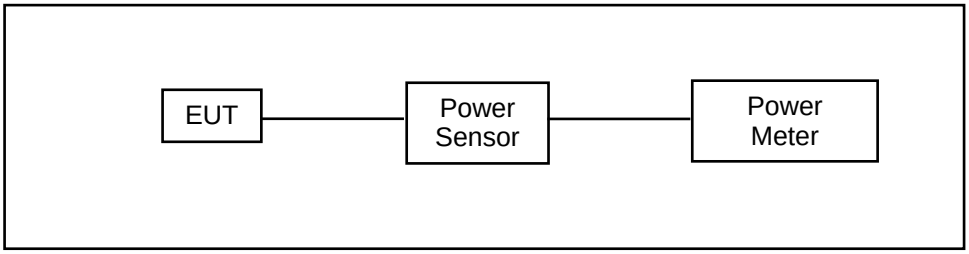
4.2. Maximum Conducted Output Power Measurement

- **Limit**

For systems using digital modulation in the 2400-2483.5 MHz, the limit for maximum output power is 30 dBm.

And According to 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

- **Test Setup**



- **Test Procedure**

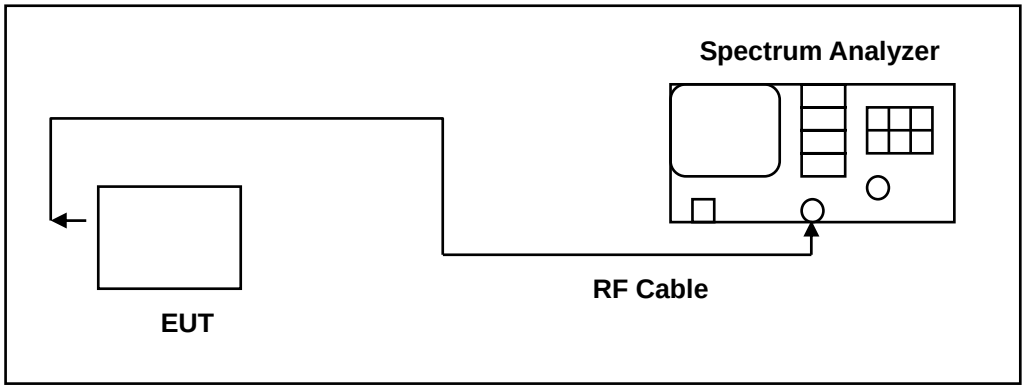
The testing follows the Measurement Procedure of ANSI C63.10-2013 section 11.9.2.3 Method AVGPM.
The tests below are run with the EUT's transmitter set at high power in TX mode. The EUT is needed to force selection of output power level and channel number. While testing, EUT was set to transmit continuously. Remove the Subjective device's antenna and connect the RF output port to power sensor.

4.3. 6 dB RF Bandwidth Measurement

■ **Limit**

6 dB RF Bandwidth: Systems using digital modulation techniques may operate in the 2400–2483.5 MHz bands. The minimum 6 dB band-width shall be at least 500 kHz.

■ **Test Setup**



■ **Test Procedure**

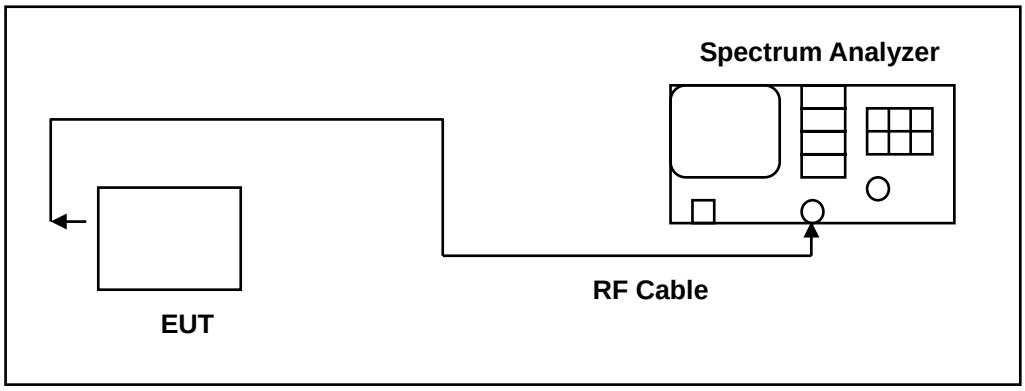
The EUT tested to DTS test procedure of KDB 558074 D01 for compliance to FCC 47CFR 15.247 requirements.
6 dB RF Bandwidth: The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A peak output reading was taken, a DISPLAY line was drawn 6 dB lower than peak level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.
The test was performed at 3 channels (Channel low, middle, high)

4.4. Maximum Power Spectral Density Measurement

■ **Limit**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

■ **Test Setup**



■ **Test Procedure**

The EUT tested to DTS test procedure of KDB 558074 D01 for compliance to FCC 47CFR 15.247 requirements.

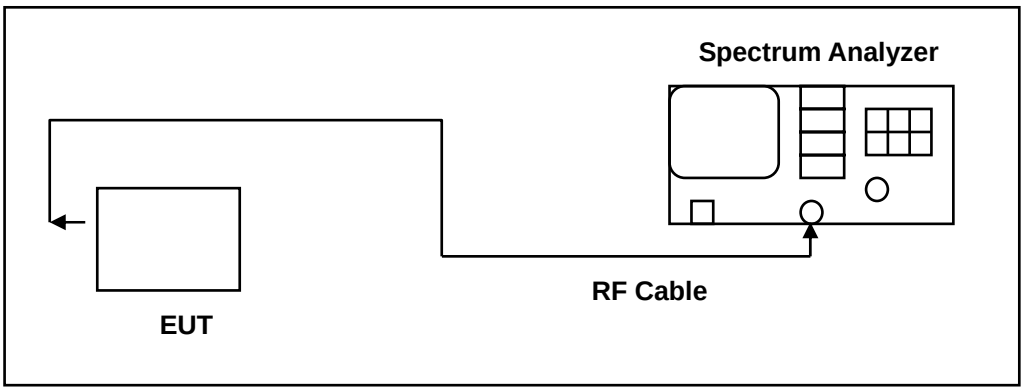
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

4.5. Out of Band Conducted Emissions Measurement

■ **Limit**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

■ **Test Setup**



■ **Test Procedure**

In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.
All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the pass band.
The test was performed at 3 channels (Channel low, middle, high)

4.6. Antenna Measurement

- **Limit**

For intentional device, according to 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And According to 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

- **Antenna Connector Construction**

See section 2 – antenna information.

5 Test Results

Annex A. Conducted Test Results

Power setting 1_Antenna Type: PCB Trace Antenna

Modulation Type	Frequency (MHz)	RF Power setting in Test Software	Test Software Version
GFSK	2405	18.00	Terminal
	2440	16.00	
	2480	16.00	

Maximum Conducted Output Power Measurement

Test Mode	Mode 1				
Frequency (MHz)	Average Power		Peak Power		Limit (dBm)
	(dBm)	(W)	(dBm)	(W)	
2405	16.81	0.04797	**20.11**	**0.10257**	≤ 30
2440	15.23	0.03334	18.70	0.07413	≤ 30
2480	15.10	0.03236	18.68	0.07379	≤ 30

6 dB RF Bandwidth and 99 % Occupied Bandwidth Measurement

Test Mode	Mode 1	
Frequency (MHz)	6 dB RF Bandwidth (kHz)	Limit (kHz)
2405	1670.000	≥ 500
2440	1672.000	≥ 500
2480	1664.000	≥ 500

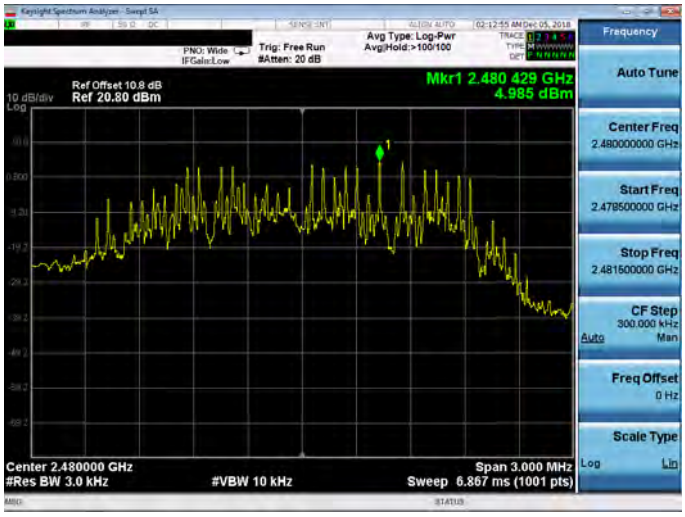
■ **Test Graphs**

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

Maximum Power Spectral Density Measurement

Test Mode	Mode 1	
Frequency (MHz)	Reading (dBm/ 3kHz)	Limit (dBm)
2405	6.658	≤ 8
2440	5.048	≤ 8
2480	4.985	≤ 8

■ **Test Graphs**

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

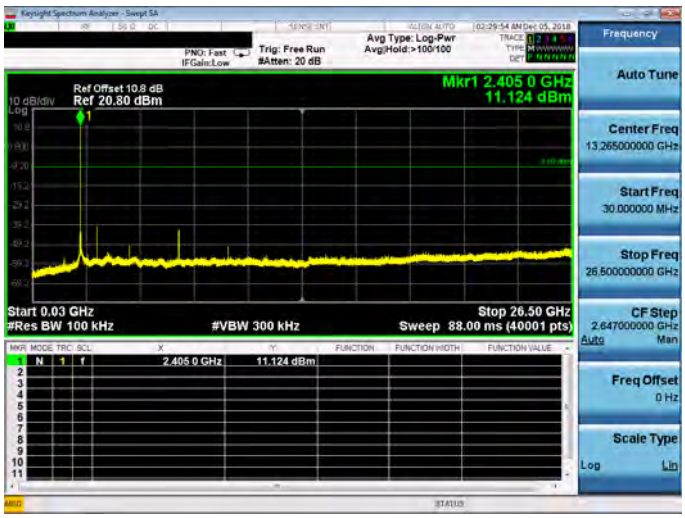
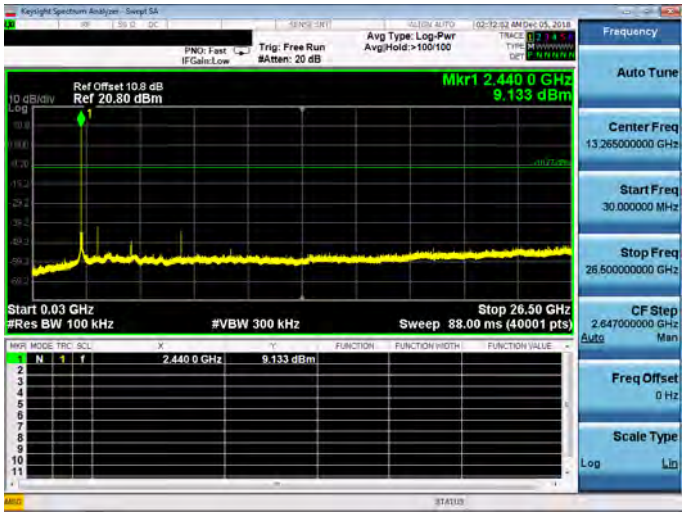
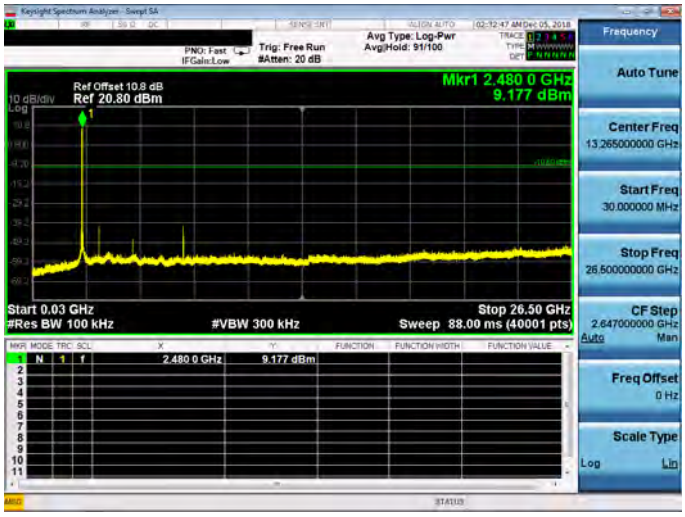
Out of Band Conducted Emissions Measurement

■ **Test Graphs**

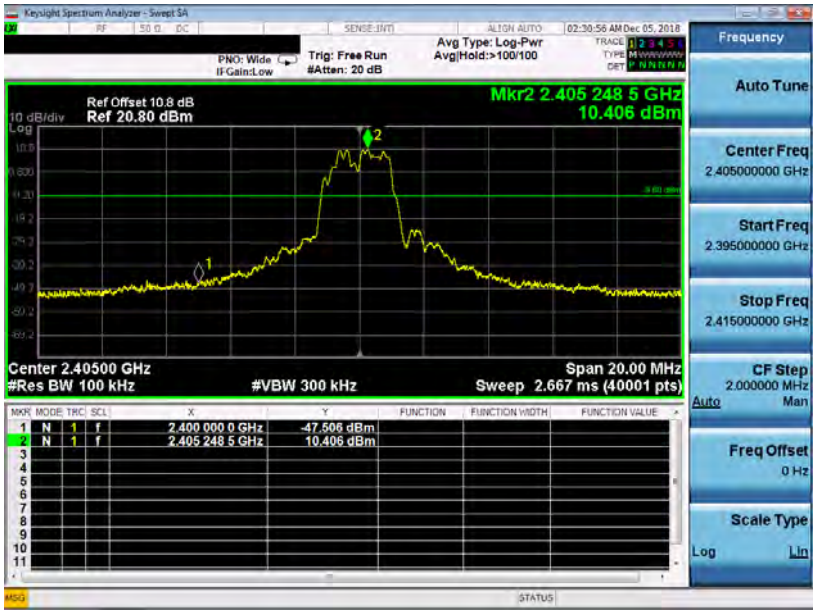
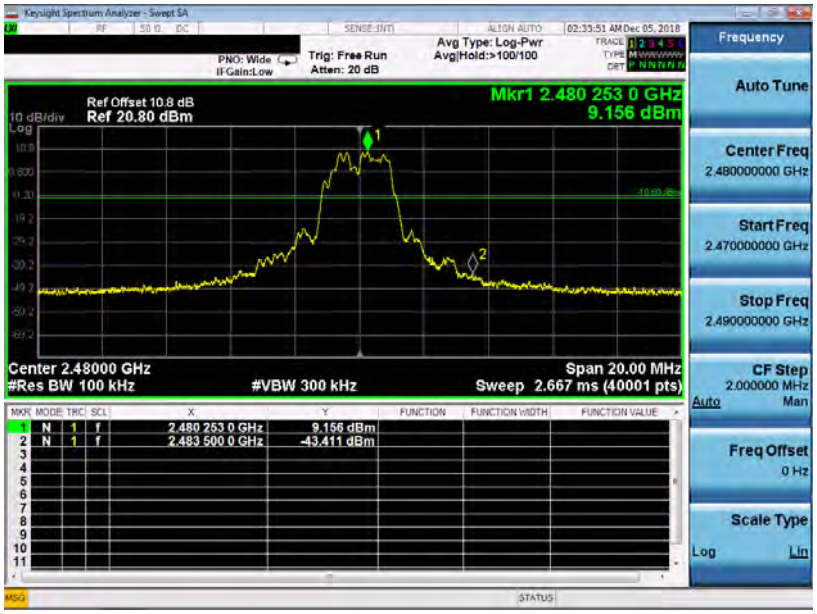
Reference level

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

Out of Band Conducted Emissions

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

Conducted Band Edge

Mode 1: Continuous TX mode	
2405 MHz	
2480 MHz	

Power setting 2_Antenna Type: Heavy Duty Screw Mount Antenna

Modulation Type	Frequency (MHz)	RF Power setting in Test Software	Test Software Version
GFSK	2405	16.00	Terminal
	2440	14.00	
	2480	14.00	

Maximum Conducted Output Power Measurement

Test Mode	Mode 1				
Frequency (MHz)	Average Power		Peak Power		Limit (dBm)
	(dBm)	(W)	(dBm)	(W)	
2405	14.93	0.03112	**18.38**	**0.06887**	≤ 30
2440	14.38	0.02742	17.91	0.06180	≤ 30
2480	14.43	0.02773	18.06	0.06397	≤ 30

6 dB RF Bandwidth and 99 % Occupied Bandwidth Measurement

Test Mode	Mode 1	
Frequency (MHz)	6 dB RF Bandwidth (kHz)	Limit (kHz)
2405	1670.000	≥ 500
2440	1670.000	≥ 500
2480	1671.000	≥ 500

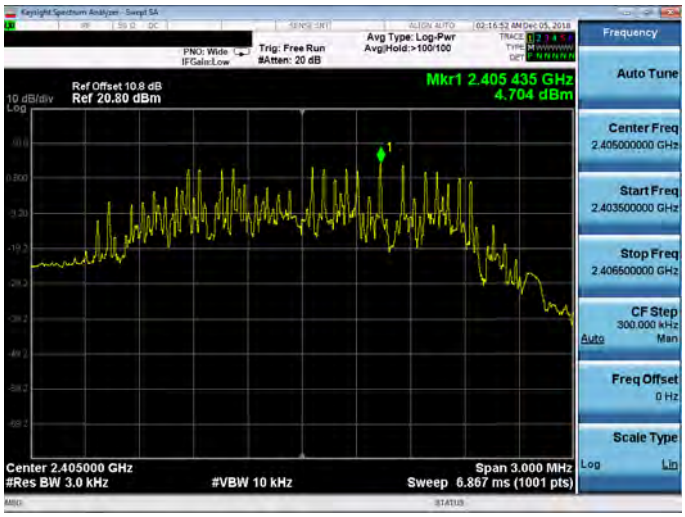
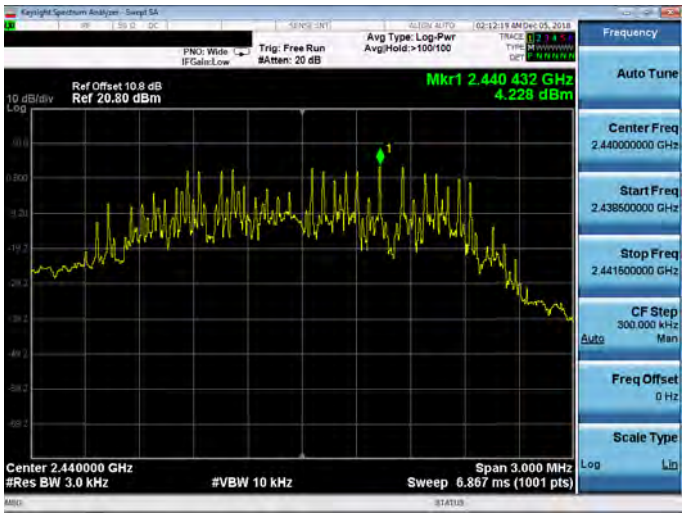
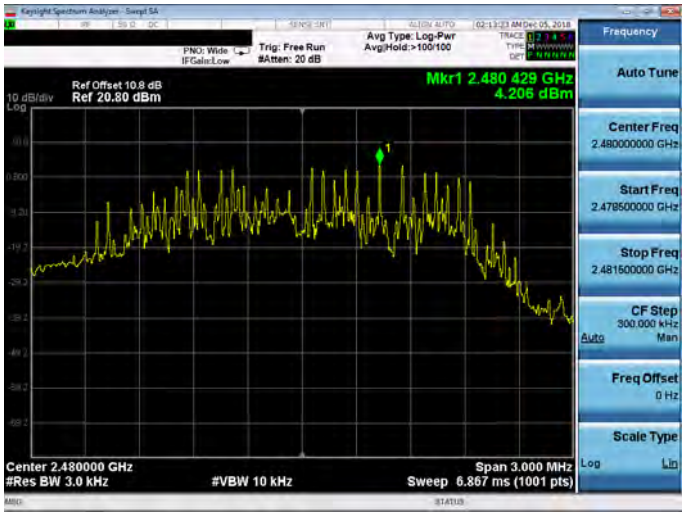
■ **Test Graphs**

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

Maximum Power Spectral Density Measurement

Test Mode	Mode 1	
Frequency (MHz)	Reading (dBm/ 3kHz)	Limit (dBm)
2405	4.454	≤ 8
2440	4.228	≤ 8
2480	4.206	≤ 8

■ **Test Graphs**

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

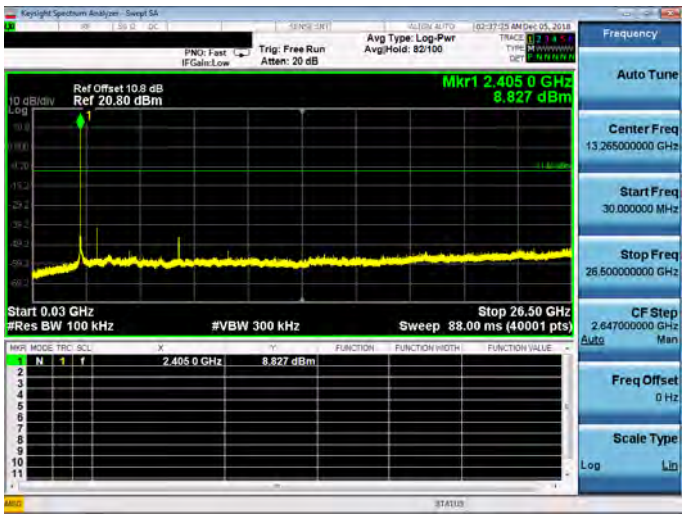
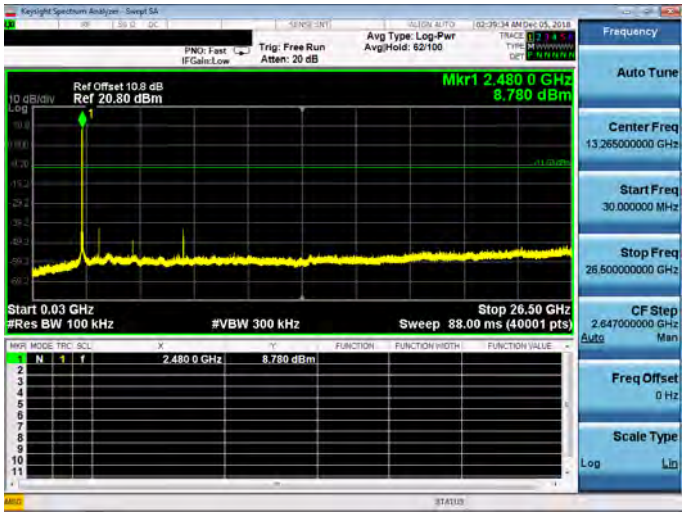
Out of Band Conducted Emissions Measurement

■ **Test Graphs**

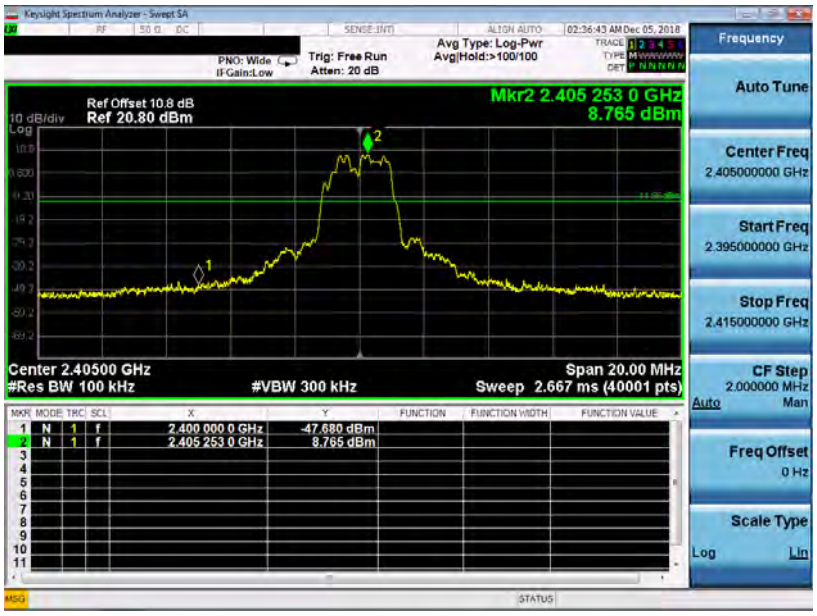
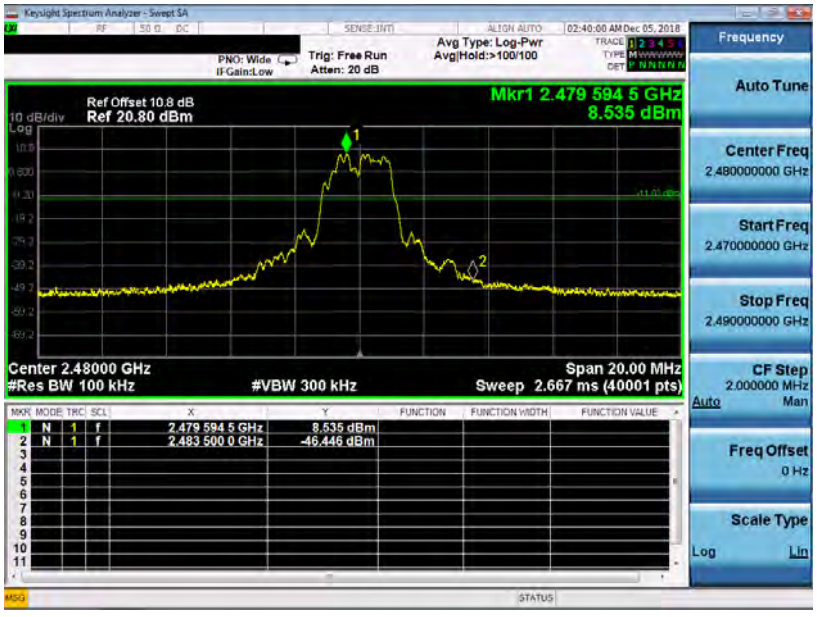
Reference level

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

Out of Band Conducted Emissions

Mode 1: Continuous TX mode	
2405 MHz	
2440 MHz	
2480 MHz	

Conducted Band Edge

Mode 1: Continuous TX mode	
2405 MHz	
2480 MHz	

Annex B. Radiated Emission Measurement

Harmonic

Power setting 1_Antenna Type: PCB Trace Antenna

Below 1 GHz

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Test Mode:	Mode 1	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
144.4600	33.90	-6.71	27.19	43.50	-16.31	QP	H
232.7300	39.92	-7.66	32.26	46.00	-13.74	QP	H
280.2600	37.64	-5.26	32.38	46.00	-13.62	QP	H
359.8000	35.40	-3.69	31.71	46.00	-14.29	QP	H
583.8700	29.40	1.02	30.42	46.00	-15.58	QP	H
776.9000	29.29	4.78	34.07	46.00	-11.93	QP	H
167.7400	36.03	-6.57	29.46	43.50	-14.04	QP	V
233.7000	35.71	-7.59	28.12	46.00	-17.88	QP	V
312.2700	34.34	-4.50	29.84	46.00	-16.16	QP	V
466.5000	29.67	-1.27	28.40	46.00	-17.60	QP	V
621.7000	29.13	1.71	30.84	46.00	-15.16	QP	V
807.9400	28.31	5.28	33.59	46.00	-12.41	QP	V

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

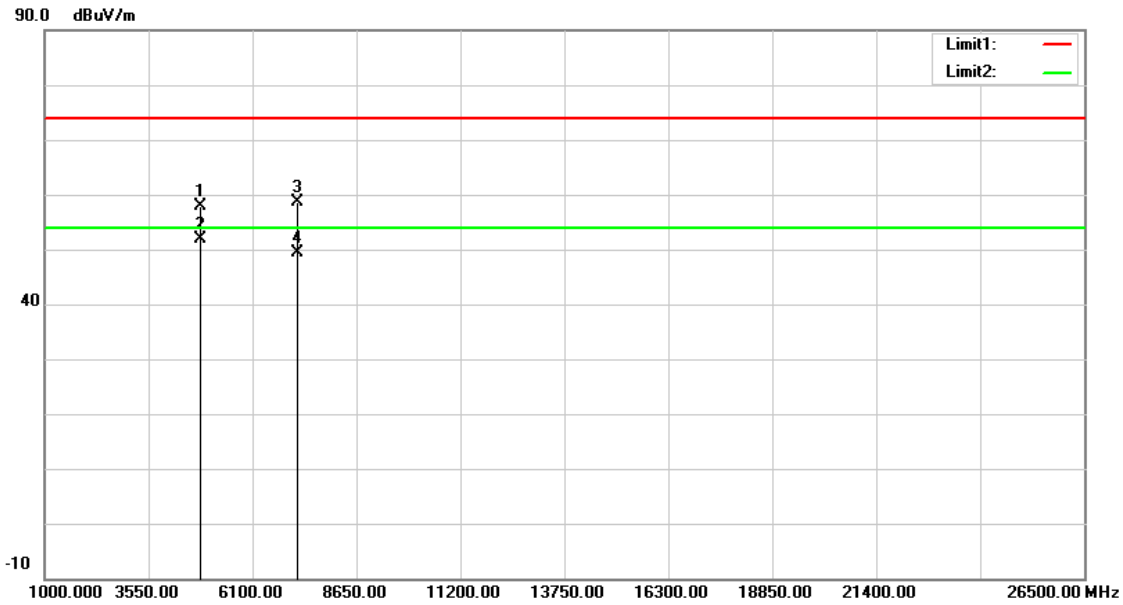
Example: 27.19 = -6.71+33.90

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Above 1 GHz

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4810.000	62.66	-4.82	57.84	74.00	-16.16	peak
2	4810.000	56.76	-4.82	51.94	54.00	-2.06	AVG
3	7215.000	59.22	-0.48	58.74	74.00	-15.26	peak
4	7215.000	49.77	-0.48	49.29	54.00	-4.71	AVG

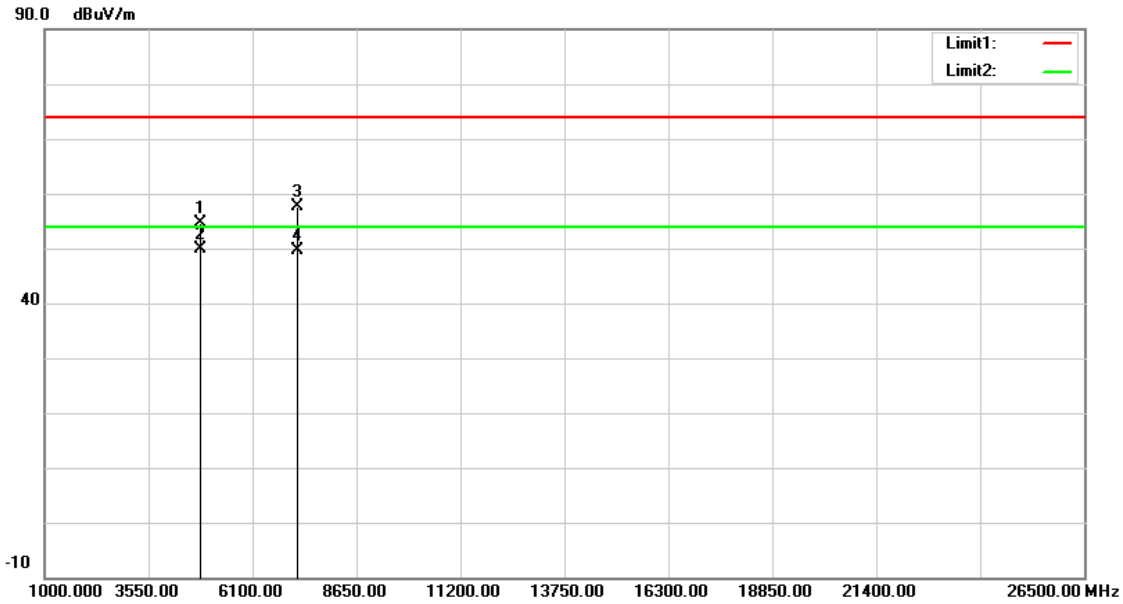
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: 57.84 = -4.82+62.66

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4810.000	59.37	-4.82	54.55	74.00	-19.45	peak
2	4810.000	54.75	-4.82	49.93	54.00	-4.07	AVG
3	7215.000	58.12	-0.48	57.64	74.00	-16.36	peak
4	7215.000	50.22	-0.48	49.74	54.00	-4.26	AVG

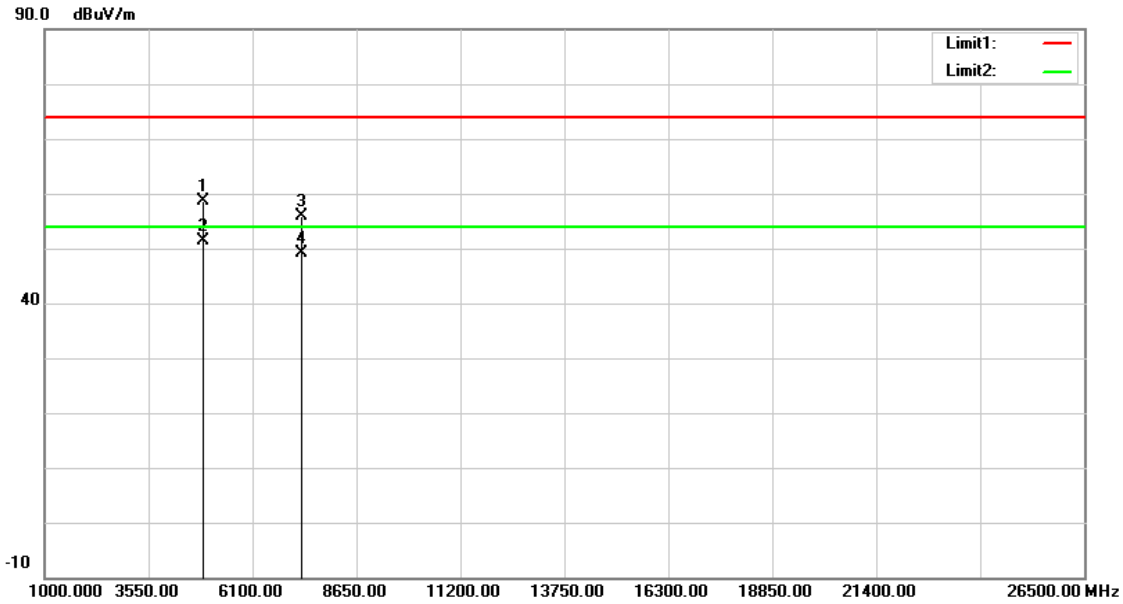
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: 54.55 = -4.82+59.37

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2440 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



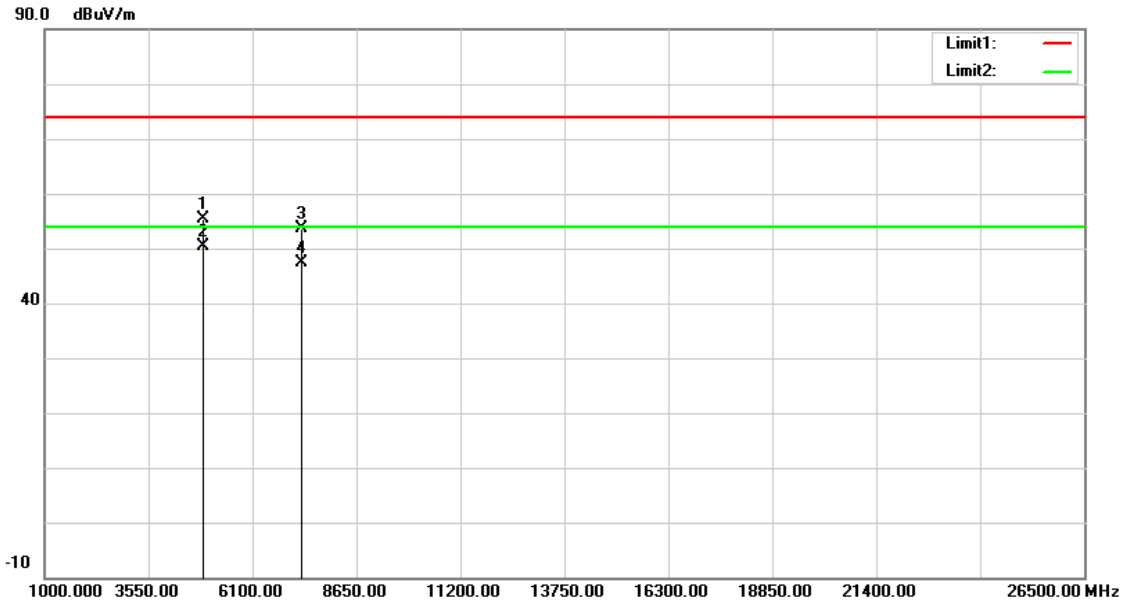
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4880.000	63.36	-4.85	58.51	74.00	-15.49	peak
2	4880.000	56.26	-4.85	51.41	54.00	-2.59	AVG
3	7320.000	55.97	-0.21	55.76	74.00	-18.24	peak
4	7320.000	49.43	-0.21	49.22	54.00	-4.78	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2440 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



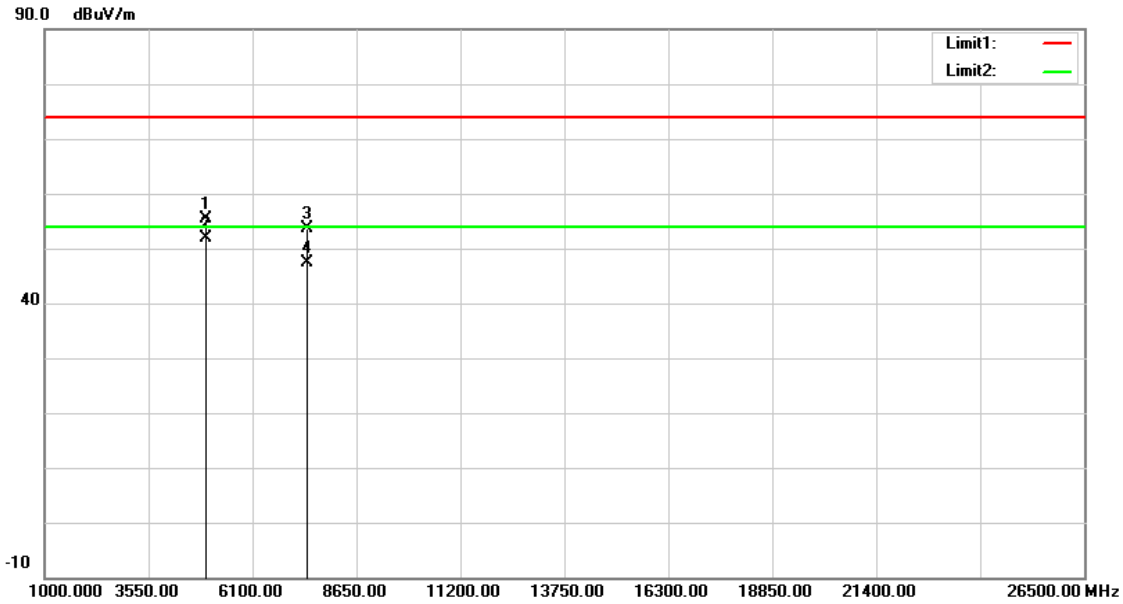
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4880.000	60.15	-4.85	55.30	74.00	-18.70	peak
2	4880.000	55.16	-4.85	50.31	54.00	-3.69	AVG
3	7320.000	53.72	-0.21	53.51	74.00	-20.49	peak
4	7320.000	47.61	-0.21	47.40	54.00	-6.60	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



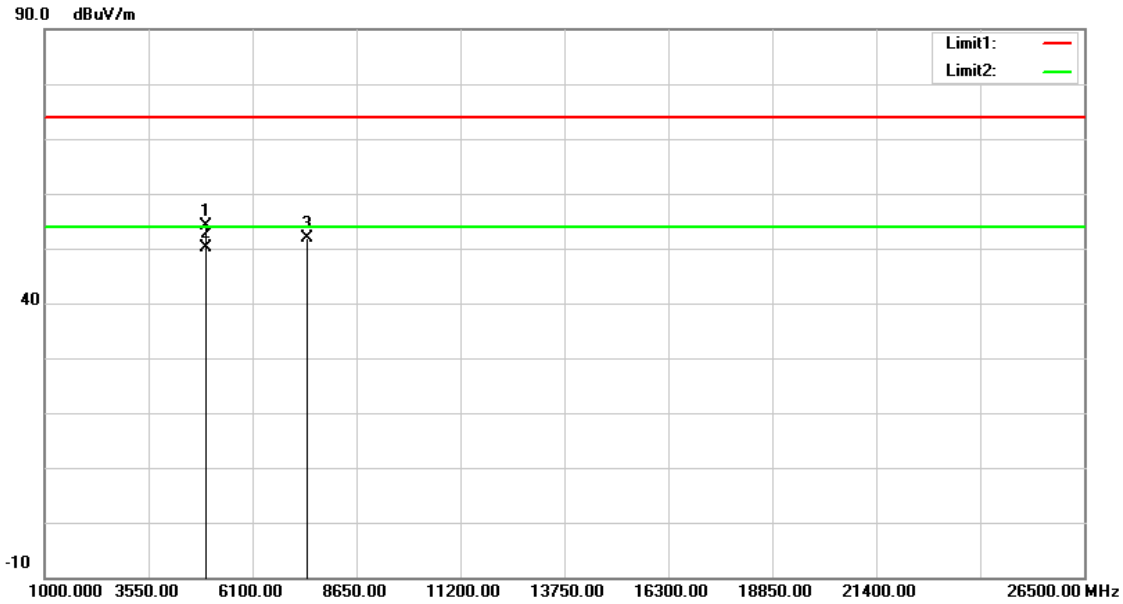
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	60.21	-4.89	55.32	74.00	-18.68	peak
2	4960.000	56.70	-4.89	51.81	54.00	-2.19	AVG
3	7440.000	53.66	0.06	53.72	74.00	-20.28	peak
4	7440.000	47.23	0.06	47.29	54.00	-6.71	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	59.02	-4.89	54.13	74.00	-19.87	peak
2	4960.000	54.93	-4.89	50.04	54.00	-3.96	AVG
3	7440.000	51.88	0.06	51.94	74.00	-22.06	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Antenna Type: Heavy Duty Screw Mount Antenna

Below 1 GHz

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Test Mode:	Mode 1	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
97.9000	42.96	-15.67	27.29	43.50	-16.21	QP	H
205.5700	40.85	-13.77	27.08	43.50	-16.42	QP	H
254.0700	36.30	-12.09	24.21	46.00	-21.79	QP	H
715.7900	34.97	-1.51	33.46	46.00	-12.54	QP	H
799.2100	34.79	0.21	35.00	46.00	-11.00	QP	H
933.0700	35.46	2.42	37.88	46.00	-8.12	QP	H
62.0100	42.86	-12.18	30.68	40.00	-9.32	QP	V
162.8900	41.86	-10.75	31.11	43.50	-12.39	QP	V
427.7000	35.11	-6.16	28.95	46.00	-17.05	QP	V
591.6300	35.39	-3.45	31.94	46.00	-14.06	QP	V
789.5100	35.00	0.19	35.19	46.00	-10.81	QP	V
925.3100	32.55	2.15	34.70	46.00	-11.30	QP	V

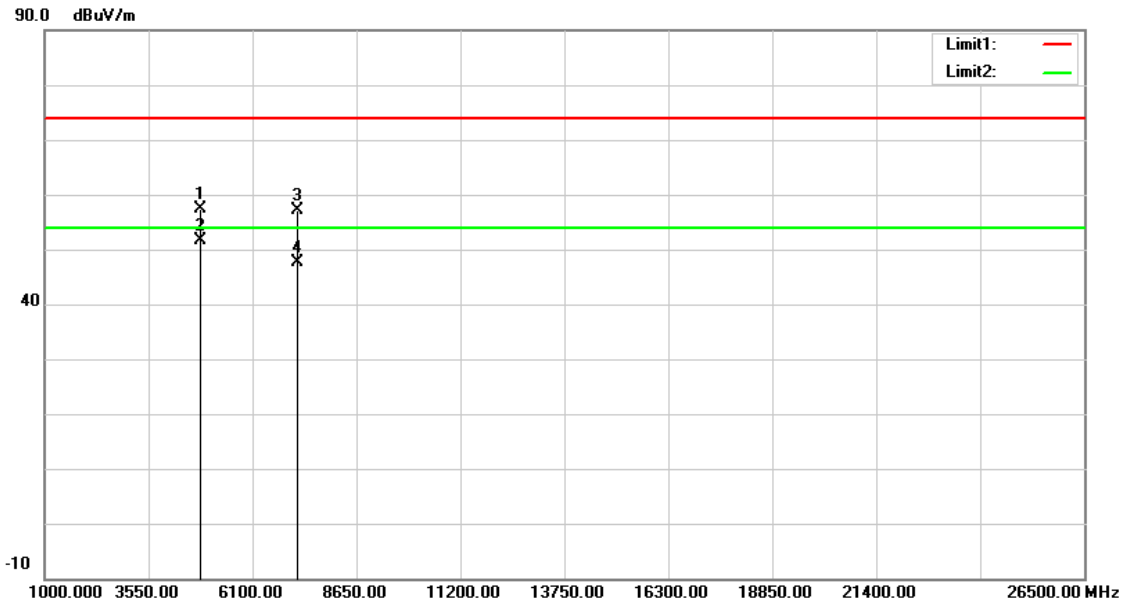
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Above 1 GHz

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



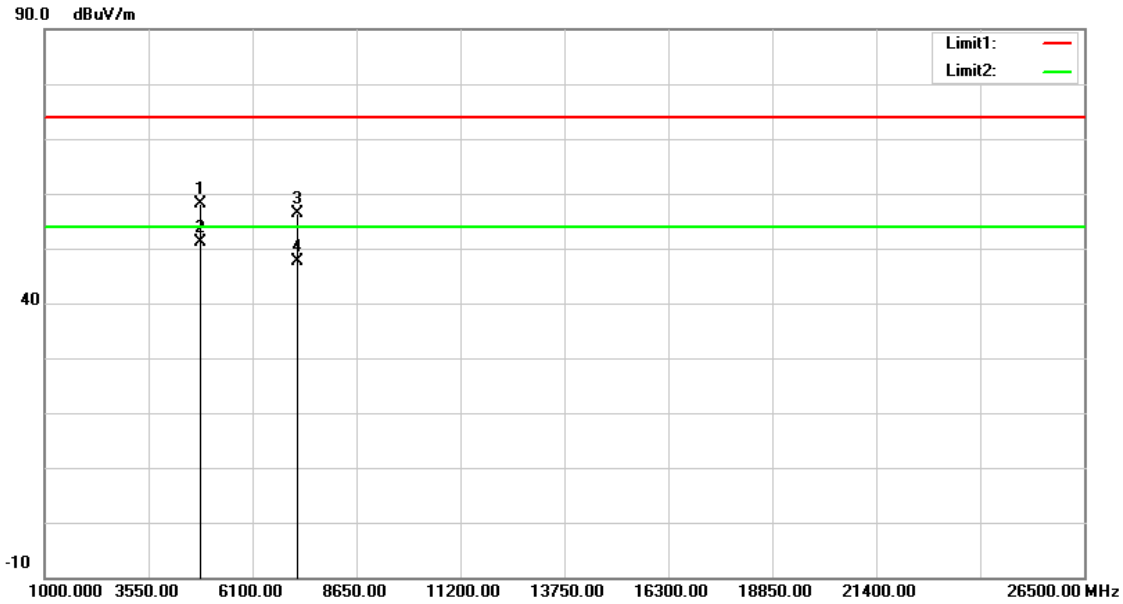
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4810.000	62.28	-4.82	57.46	74.00	-16.54	peak
2	4810.000	56.38	-4.82	51.56	54.00	-2.44	AVG
3	7215.000	57.62	-0.48	57.14	74.00	-16.86	peak
4	7215.000	48.16	-0.48	47.68	54.00	-6.32	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



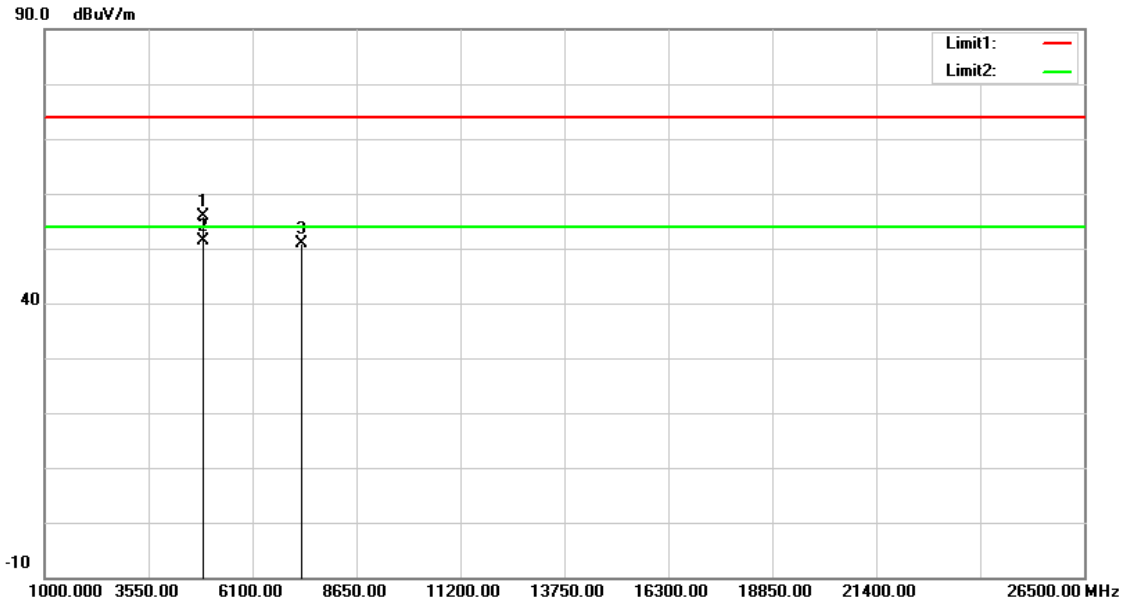
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4810.000	63.05	-4.82	58.23	74.00	-15.77	peak
2	4810.000	55.91	-4.82	51.09	54.00	-2.91	AVG
3	7215.000	56.88	-0.48	56.40	74.00	-17.60	peak
4	7215.000	48.05	-0.48	47.57	54.00	-6.43	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2440 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



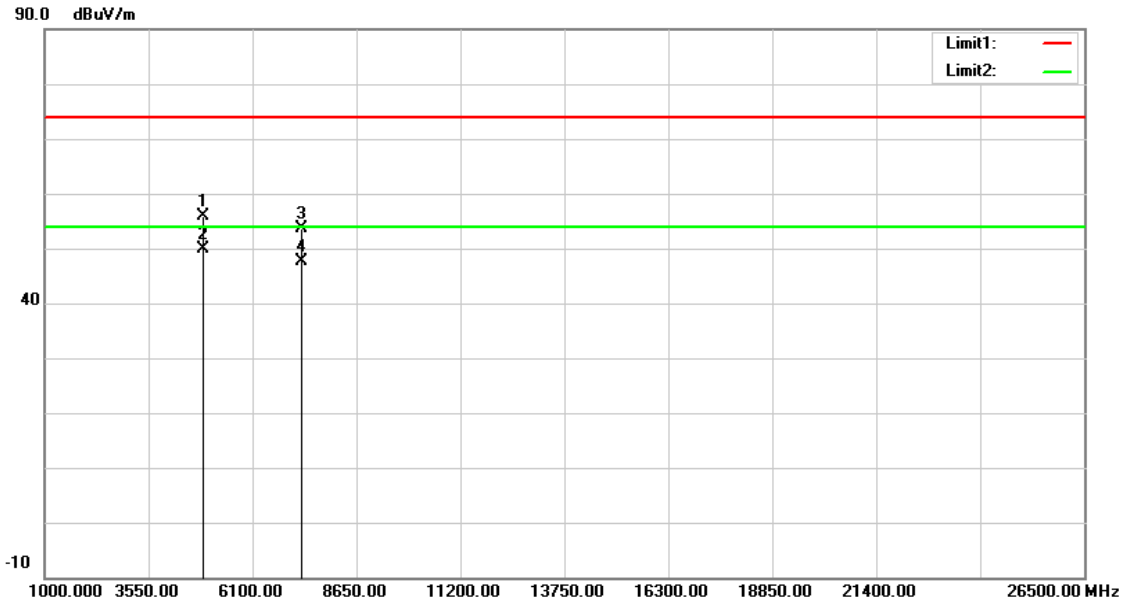
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4880.000	60.66	-4.85	55.81	74.00	-18.19	peak
2	4880.000	56.32	-4.85	51.47	54.00	-2.53	AVG
3	7320.000	51.11	-0.21	50.90	74.00	-23.10	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2440 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



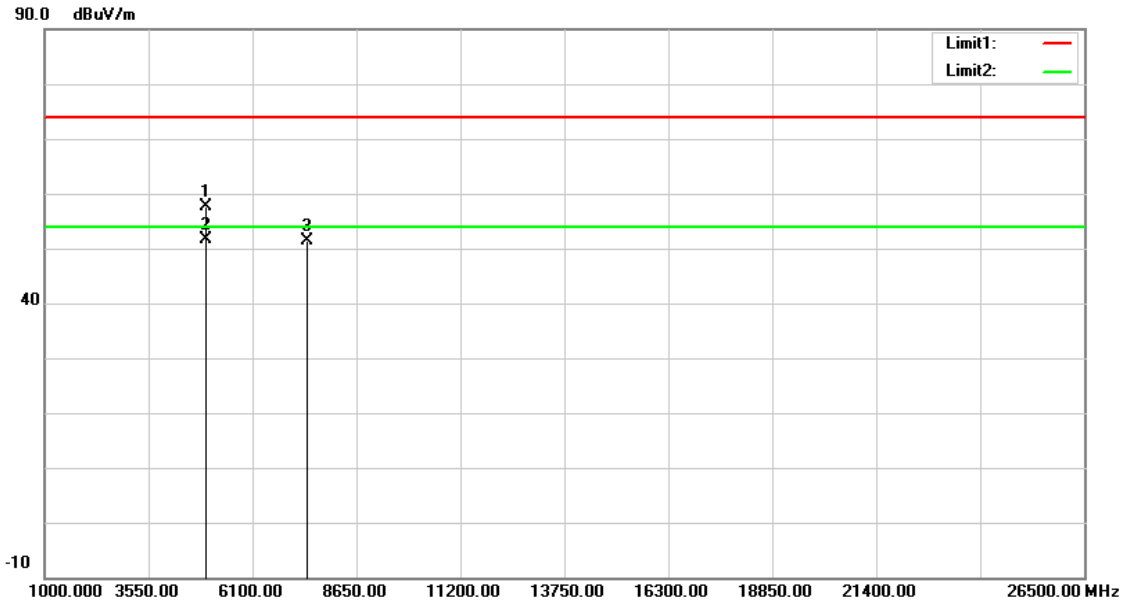
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4880.000	60.85	-4.85	56.00	74.00	-18.00	peak
2	4880.000	54.65	-4.85	49.80	54.00	-4.20	AVG
3	7320.000	53.92	-0.21	53.71	74.00	-20.29	peak
4	7320.000	47.79	-0.21	47.58	54.00	-6.42	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



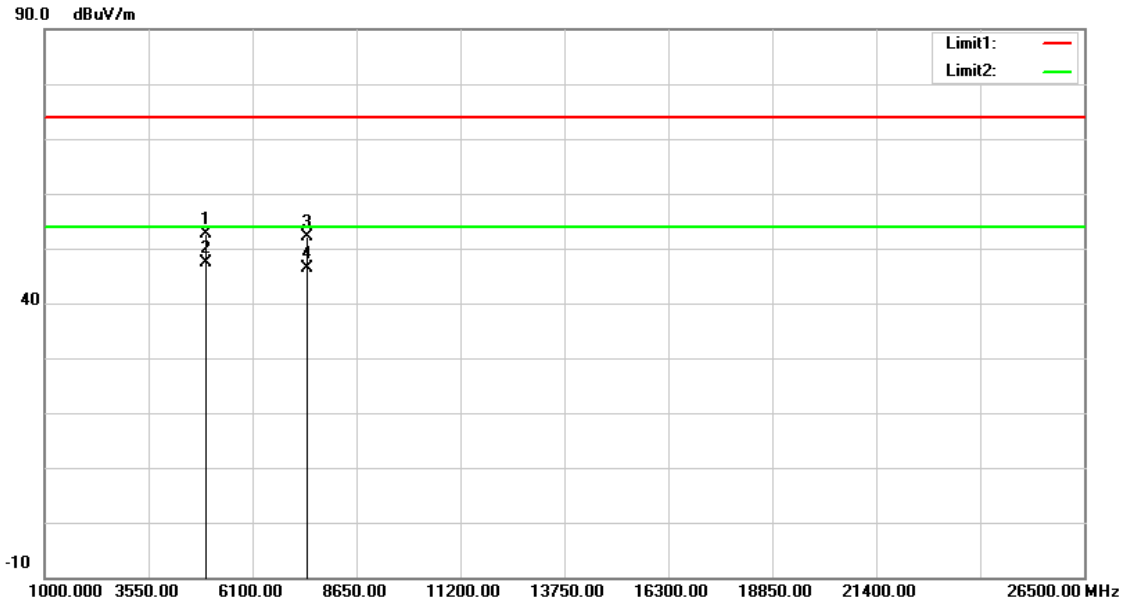
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	62.42	-4.89	57.53	74.00	-16.47	peak
2	4960.000	56.41	-4.89	51.52	54.00	-2.48	AVG
3	7440.000	51.27	0.06	51.33	74.00	-22.67	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	57.51	-4.89	52.62	74.00	-21.38	peak
2	4960.000	52.26	-4.89	47.37	54.00	-6.63	AVG
3	7440.000	52.03	0.06	52.09	74.00	-21.91	peak
4	7440.000	46.39	0.06	46.45	54.00	-7.55	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

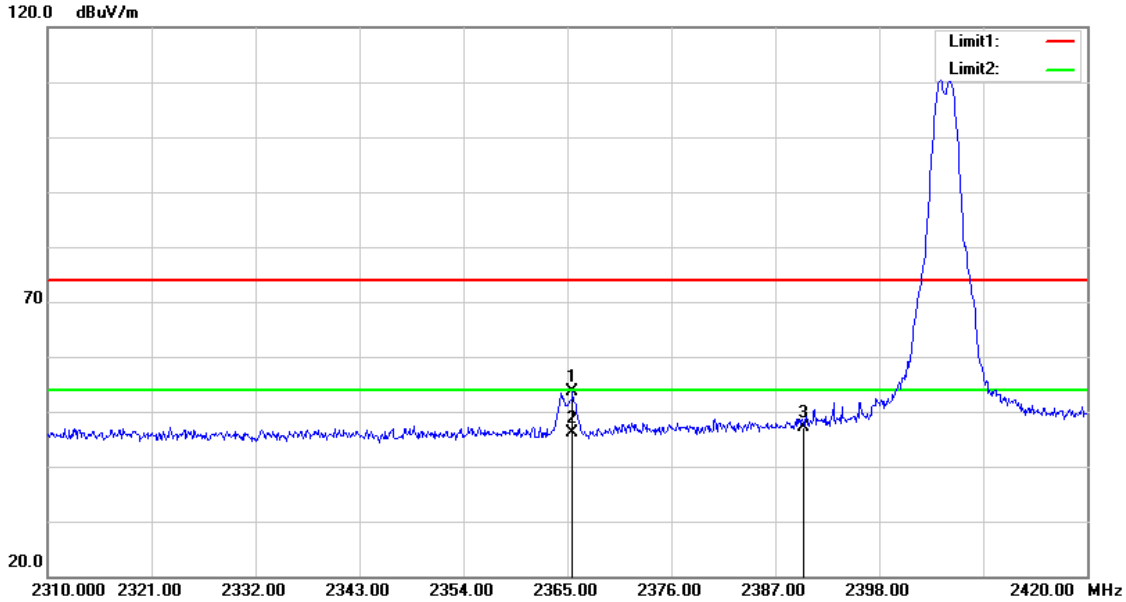
2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Band Edge

Antenna Type: PCB Trace Antenna

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



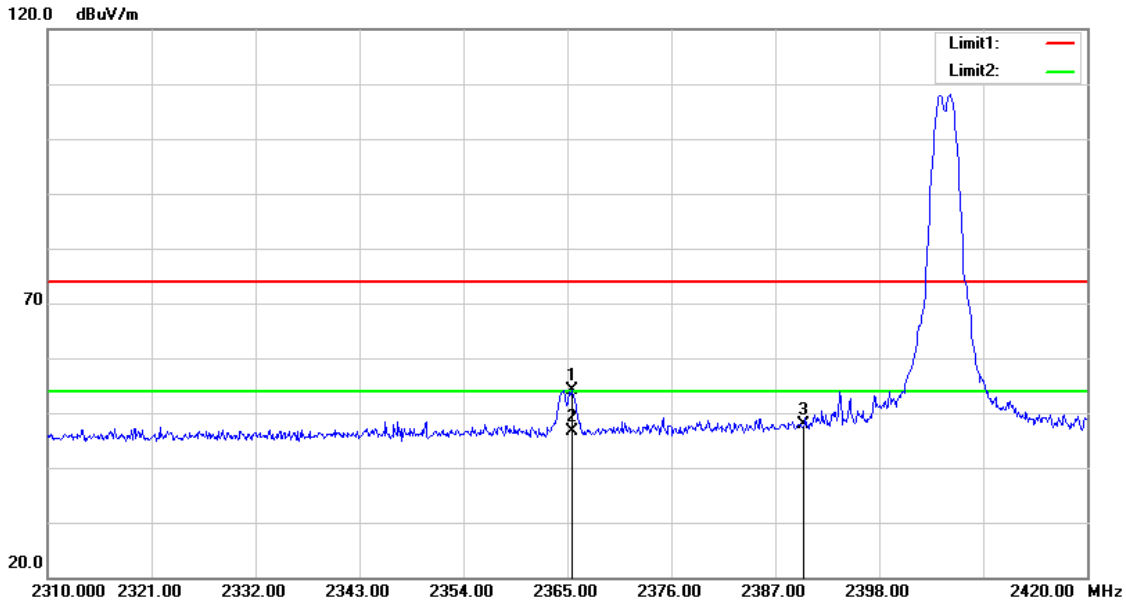
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2365.550	63.44	-9.71	53.73	74.00	-20.27	peak
2	2365.550	55.85	-9.71	46.14	54.00	-7.86	AVG
3	2390.000	56.87	-9.62	47.25	74.00	-26.75	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



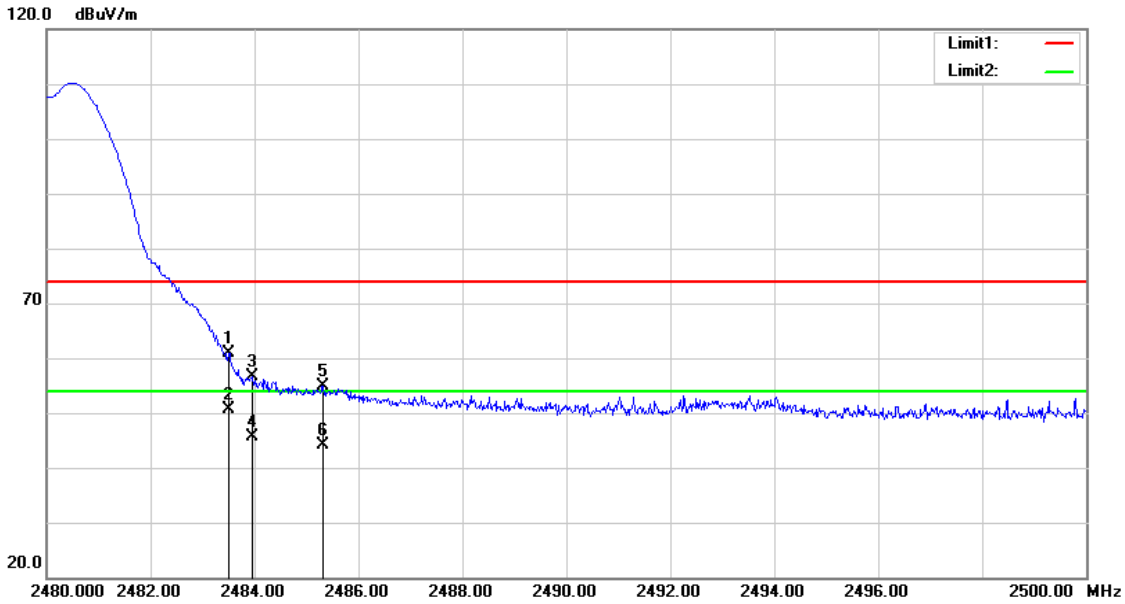
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2365.550	63.75	-9.71	54.04	74.00	-19.96	peak
2	2365.550	56.42	-9.71	46.71	54.00	-7.29	AVG
3	2390.000	57.58	-9.62	47.96	74.00	-26.04	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



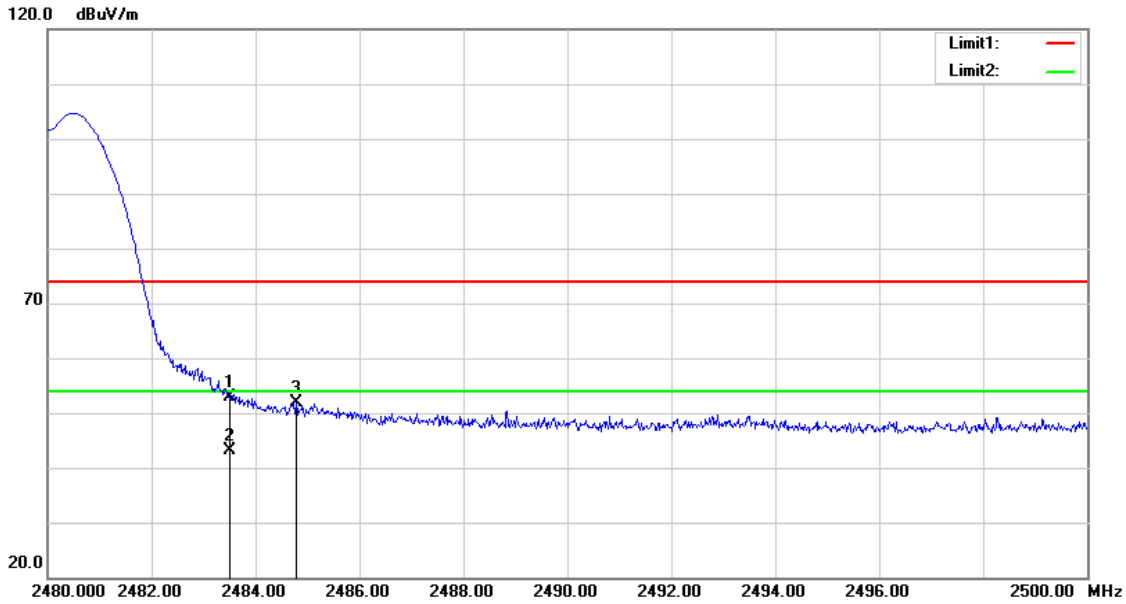
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	70.24	-9.37	60.87	74.00	-13.13	peak
2	2483.500	59.89	-9.37	50.52	54.00	-3.48	AVG
3	2483.960	65.99	-9.37	56.62	74.00	-17.38	peak
4	2483.960	55.04	-9.37	45.67	54.00	-8.33	AVG
5	2485.320	64.20	-9.37	54.83	74.00	-19.17	peak
6	2485.320	53.43	-9.37	44.06	54.00	-9.94	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	62.24	-9.37	52.87	74.00	-21.13	peak
2	2483.500	52.38	-9.37	43.01	54.00	-10.99	AVG
3	2484.780	61.14	-9.37	51.77	74.00	-22.23	peak

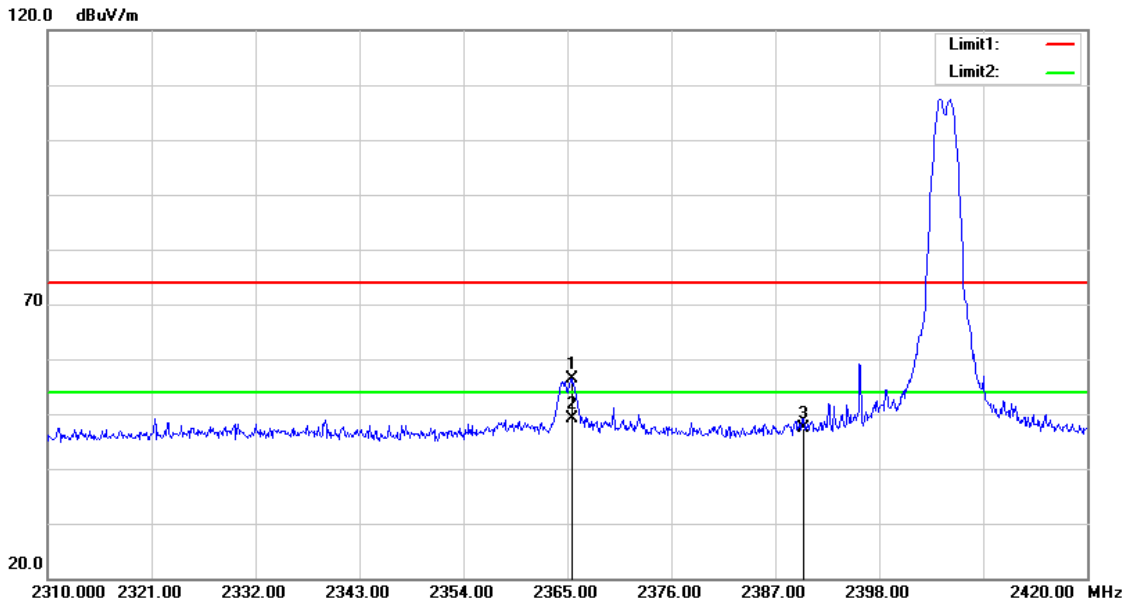
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Antenna Type: Heavy Duty Screw Mount Antenna

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



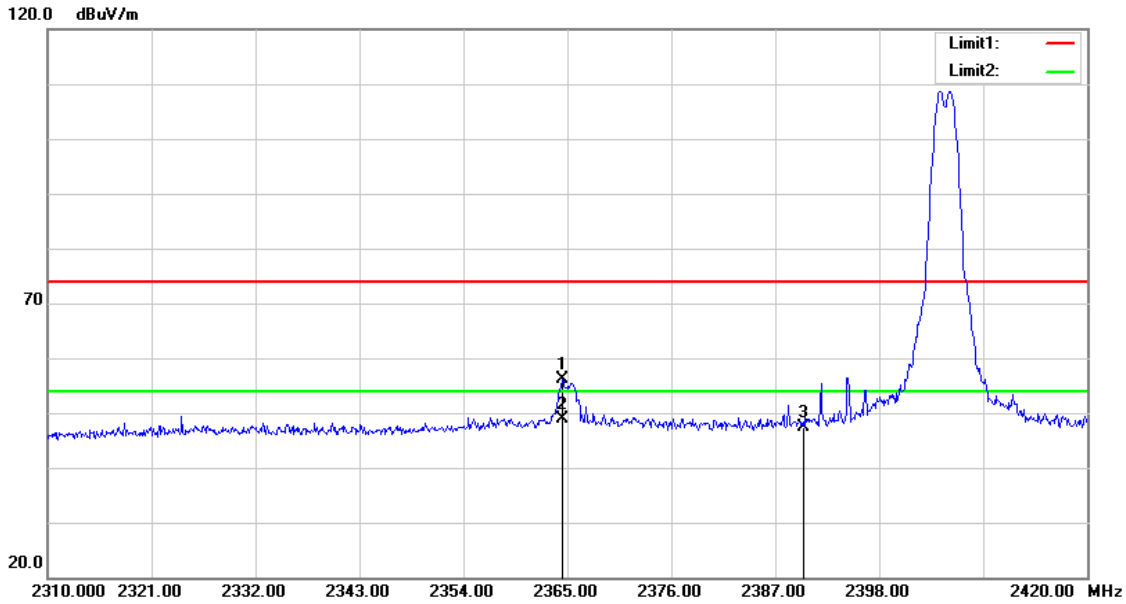
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2365.440	65.99	-9.71	56.28	74.00	-17.72	peak
2	2365.440	58.79	-9.71	49.08	54.00	-4.92	AVG
3	2390.000	56.88	-9.62	47.26	74.00	-26.74	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2405 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



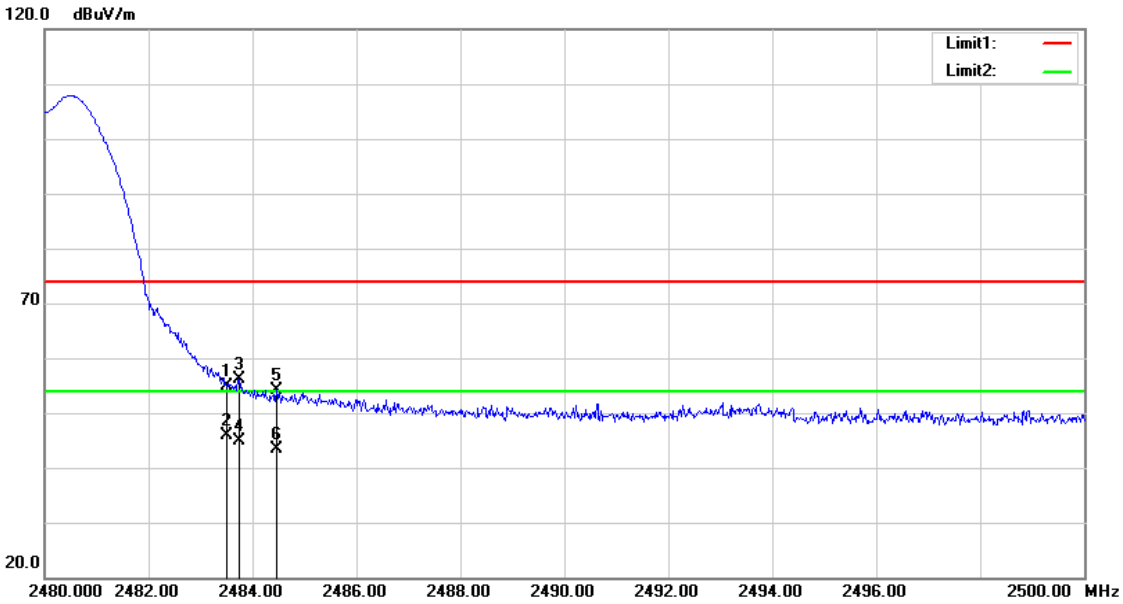
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2364.450	65.84	-9.72	56.12	74.00	-17.88	peak
2	2364.450	58.63	-9.72	48.91	54.00	-5.09	AVG
3	2390.000	57.06	-9.62	47.44	74.00	-26.56	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



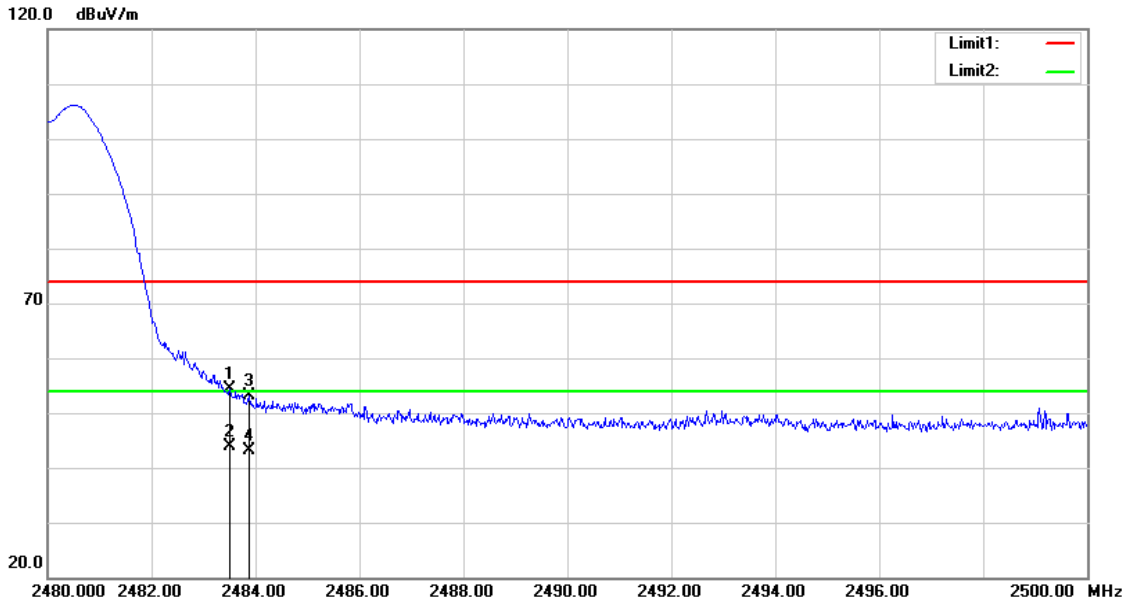
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	64.28	-9.37	54.91	74.00	-19.09	peak
2	2483.500	55.32	-9.37	45.95	54.00	-8.05	AVG
3	2483.740	65.57	-9.37	56.20	74.00	-17.80	peak
4	2483.740	54.15	-9.37	44.78	54.00	-9.22	AVG
5	2484.460	63.51	-9.37	54.14	74.00	-19.86	peak
6	2484.460	52.65	-9.37	43.28	54.00	-10.72	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge	Power:	DC 3.3 V
Frequency:	2480 MHz	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	63.69	-9.37	54.32	74.00	-19.68	peak
2	2483.500	53.35	-9.37	43.98	54.00	-10.02	AVG
3	2483.880	62.42	-9.37	53.05	74.00	-20.95	peak
4	2483.880	52.58	-9.37	43.21	54.00	-10.79	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.